

	Type	L #	Hits	Search Text	DBs	Time Stamp
1	BRS	L1	2	electrolyte same cation same anode same (electrochemical adj reaction adj cell)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:40
2	BRS	L2	6276	(electrochemical\$3) same (interconnect\$3 or plug\$3 or contact\$3) same electrolyte	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:52
3	BRS	L4	1	2 and 3	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:42
4	BRS	L3	15	(electrolyte) same ((titanium adj trichloride) or (tatanium adj sulfate) or (titanium adj bromide) or (titanium adj trichloride) or (titanium adj iodide) or (titanium adj fluoride))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:43
5	BRS	L5	15	electrolyte same ((titanium adj trichloride) or (titanium adj sulfate))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:51

PAT-NO:

JP02000351622A

DOCUMENT-IDENTIFIER:

JP 2000351622 A

TITLE:

PRODUCTION OF TITANIUM (III) SULFATE

----- KWIC -----

SOLUTION: A composite membrane obtained by laminating a cation exchange film to an anion exchange film is sufficient as a bipolar membrane. The composite membrane impermeable to ions except hydrogen ion and hydroxyl ion is preferable for the purpose. High-purity titanium (IV) sulfate is used. In order to carry out stable electrolytic reduction from an early stage, an aqueous solution of the titanium sulfate is made into an acidic solution having pH 0-5 and the concentration of the solution is 10-200 g/litter calculated as  $TiO_2$ . An aqueous solution of sodium hydroxide having 0.2-3 N concentration is used as an electrolyte to be used in an anode chamber. The current density is 0.1-100 A/dm<sup>2</sup> and the temperature is 0-100

US-PAT-NO: 6284652  
DOCUMENT-IDENTIFIER: US 6284652 B1  
TITLE: Adhesion promotion method for  
electro-chemical copper metallization in IC applications

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In a first alternative embodiment of the present invention the step 44 (FIG. 3) of depositing second layer of copper 48 (FIG. 4) onto the first layer 20 is carried out by electroplating. The electroplated second layer of copper is a thick or bulk layer which fills via 11 and covers other features. Electroplating is suitable for depositing second layer 48 because it is an economical and well-known process, it provides uniform coverage, good adherence to copper surfaces such as first layer 20, and provides acceptable deposition rates. Electroplating systems and methods are well known to those skilled in the art of integrated circuit interconnect technology. Typically, the substrate is inverted over or immersed in an electro-chemical cell or bath. The reservoir of the cell contains a copper-containing electrolytic solution, such as Sel-Rex Copper Electroplating Solution, made by Enthone-OMI, Inc., or another suitable commercially available copper plating solution. Other ingredients may be present to control the nature of the copper deposit. The copper containing electrolyte typically contains copper sulfate (CuSO.sub.4) and sulfuric acid (H.sub.2 SO.sub.4) plus additives. An electrical potential is established between the seed copper layer on the

substrate, layer 20, which forms the cathode, and an anode immersed in the electrolytic bath. A pulsed or continuous plating current is employed to release copper ions from the electrolyte and deposit metallic copper on the cathode seed layer 20. Typical plating currents of 20-200  $\mu\text{A}/\text{cm}^2$  (microamperes per square centimeter) are employed in electroplating. If pulsed currents are used, suitable pulse durations range from 1-20 milliseconds on, and 5-60 milliseconds off.

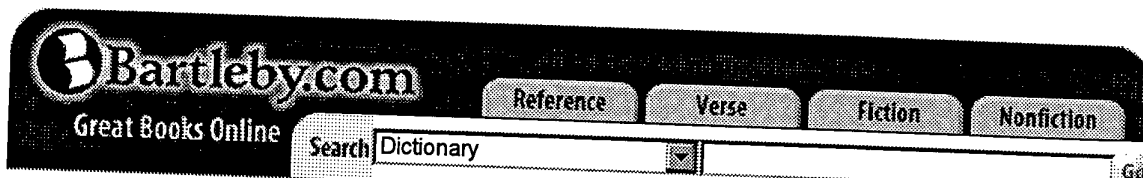


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The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

## electrolyte

SYLLABICATION: e·lec·tro·lyte

PRONUNCIATION: ɪˈlɛkˈtrɒliːt

NOUN: 1. A chemical compound that ionizes when dissolved or molten to produce an electrically conductive medium. 2. *Physiology* Any of various ions, such as sodium, potassium, or chloride, required by cells to regulate the electric charge and flow of water molecules across the cell membrane.

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DOCUMENT-IDENTIFIER: US 20020134684 A1

TITLE: Seed layer processes

----- KWIC -----

[0050] Discontinuities in a seed layer may be repaired by laterally enhancing the growth of the copper during an electroplating step such that the copper seed grows across the discontinuities. Such method is also referred to as lateral growth enhancement. For example, see PCT Patent Application WO 99/47731 (Chen), herein incorporated by reference. In this method, a copper seed layer coated wafer is immersed in an alkaline copper containing electrolyte solution, preferably in an alkaline copper bath wherein the copper ions are complexed with a complexing agent such as EDTA, citric acid, ethylene diamine and the like. The pH of this copper bath is preferably at least about 9.

DERWENT-ACC-NO: 1989-206763

DERWENT-WEEK: 198928

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TITLE: Electrochemical system with anode  
and cathode  
compartments - has ion and gas  
permeable membrane sepg.  
compartments

----- KWIC -----

An electrode apparatus (21) (adapted for a self-regenerable electrochemical cell (10)) containing excess free electrolyte and having an anode compartment (20) containing anode solution and a cathode compartment (18) containing cathode solution of different composition than said anode solution, in which gas and ions are produced and consumed in said compartments during electrical current generation by said system, whereby an ionic concentration difference is established in the said cell (10); an electromotive force is created due to the said concentration difference; during normal cell operation a gas is created as the result of the electrochemical reaction responsible for the said electromotive force in one compartment (18, 20) while consumed during the respective electrochemical reaction at the other cell compartment (20, 18); and the acid and base consumed during operation of the cell (10) are continually regenerated by thermal decomposing the salt formed by the combination of the cation of the base and the anion of the acid, wherein said electrode apparatus comprises: a membrane (22) for separating said anode compartment (20) from said

cathode compartment (18), said membrane having a cathode side and an anode side and comprising ion-permeable regions to provide transfer of ions while limiting the flow of solution between the cathode and anode sides of the membrane to thereby maintain said anode solution separate from said cathode solution, and gas-permeable regions to provide transfer of gases between the cathode and anode sides of the membrane; cathode means (24) located in the cathode compartment on said cathode side of the membrane (22) and in contact with said membrane for generating electric current; and anode means (26) located in the anode compartment on said anode side of the membrane and in contact with said membrane for generating electric current wherein gas and ions generated at said cathode means and anode means migrate through said membrane to provide transfer of said gas and ions between said anode and cathode compartments while limiting said flow of solution.



DERWENT-ACC-NO: 2001-023304

DERWENT-WEEK: 200212

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TITLE: Formation of copper plug contact on  
substrate comprises performing electrochemical deposition  
of a copper layer in separate deposition stages with a  
dwell period between the stages

----- KWIC -----

An INDEPENDENT CLAIM is also included for a method of forming a dual damascene copper interconnect metallurgy involving depositing an insulative layer on the substrate, patterning via openings and grooves which define an interconnection metallurgy in the insulative layer, depositing a barrier layer on the insulative layer, depositing a copper seed layer on the barrier layer, placing the wafer in an electrolyte having copper salts and a brightener additive, agitating the electrolyte, depositing a first copper layer on the substrate by applying current at a first current density for a first time period, stopping the current for a second time period while maintaining the agitation, depositing a second copper layer on the substrate by applying current at a second current density for a third time period such that the via openings and the grooves are filled with the copper to a level which lies above the plane of the barrier layer adjacent to the grooves and the openings, and polishing away portions of the copper and the barrier layer which lie on the

surface of the wafer adjacent to the grooves and the via openings.

DOCUMENT-IDENTIFIER: US 20030000844 A1

TITLE: Method for achieving copper fill of  
high aspect ratio interconnect features

----- KWIC -----

[0087] The substrate is then transferred to an electrochemical deposition system, and the interconnect features on the substrate are filled using an electrochemical deposition or electroplating cell containing a highly resistive electrolyte. For copper metallization, the electrolyte comprises  $\text{CuSO}_4$  having a molar concentration between about 0.5M and about 1.1M, HCl at a concentration between about 50 ppm and about 100 ppm, a carrier additive at a concentration between about 12.5 ml/l and about 20 ml/l,  $\text{H}_2\text{SO}_4$  having a concentration less than about 0.2 percent. The metallization or filling of the feature is accomplished by applying a first power density to the plating surface (i.e., seed layer) at about 2 mA/cm<sup>2</sup> for about 18 seconds followed by a second power density at about 40 mA/cm<sup>2</sup> for about 90 seconds. The electrolyte is flowed at between 2 gpm and about 4.5 gpm during the electroplating process. No substrate rotation is required to achieve uniform deposition results.

	Type	L #	Hits	Search Text	DBs	Time Stamp
6	BRS	L6	2269	(electrolyte) same cation\$3 same anode	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:49
7	BRS	L7	3073	(electrochemical\$3) with (interconnect\$3 or plug\$3 or contact\$3) with electrolyte	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:52
8	BRS	L8	40	(electrochemical\$3) same oxide\$3 same electrolyte same cation same anode	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 16:53
9	BRS	L9	12	7 and 8	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 17:10
10	BRS	L10	62	(deposit\$3) with (interconnect) with electrolyte	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 18:53

	Type	L #	Hits	Search Text	DBs	Time Stamp
11	BRS	L11	2	10 same (copper adj sulfate)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 17:35
12	BRS	L13	0	(complex\$3 adj agent) same (ethylene adj3 diamine adj3 tetra adj3 acetage)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 18:56
13	BRS	L14	665	(electrolyte) same (copper adj sulfate)	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 18:57
14	BRS	L15	4	14 same (interconnect) same copper	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:05
15	BRS	L16	69843	EDTA	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:05

	Type	L #	Hits	Search Text	DBs	Time Stamp
16	BRS	L17	10244	16 same agent	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:06
17	BRS	L18	3245	17 same PH	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:06
18	BRS	L19	35	18 same electrolyte	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:09
19	BRS	L20	0	19 same ((titanium adj3 trichloride) or (titanium adj3 sulfate))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:15
20	BRS	L21	5	electrolyte with ((titanium adj trichloride) or (titanium adj sulfate))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:16

	Type	L #	Hits	Search Text	DBs	Time Stamp
21	IS&R	L22	736	(438/618).CCLS.	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:19
22	BRS	L24	1	22 and ((titanium adj trichloride) or (titanium adj sulfate))	USPAT; US-PGP UB; EPO; JPO; DERWEN T; IBM_TD B	2003/04/05 19:19